

ARA Automatic Recloser

iC60 Circuit Breakers

Reference Manual

01/2013



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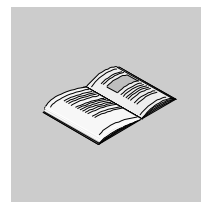
All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to observe this information can result in injury or equipment damage.

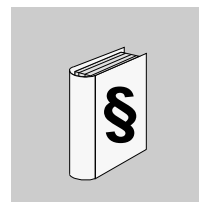
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Safety Information



Important Information

NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

NOTICE

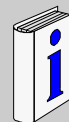
NOTICE is used to address practices not related to physical injury.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

About the Book



At a Glance

Document Scope

This manual is intended for designers and installers of control systems and electrical protection systems.

Validity Note

ARA automatic reclosers are designed to automatically reclose iC60 circuit breakers after they have tripped.

Related Documents

Title of Documentation	Reference Number
Instruction Sheet for ARA iC60 Automatic Reclosers (English, Dutch, French, German, Italian, Portuguese, Spanish, Chinese, Russian)	S1B6233501

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User Comments

We welcome your comments about this document. You can reach us by e-mail at techcomm@schneider-electric.com.

Presentation

1

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
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Presentation

Introduction

ARA automatic reclosers are designed to automatically reclose the associated protective device after it has tripped.

A number of different models are available for iC60 1 to 4-pole circuit breakers.

Functions

The ARA iC60 automatic recloser functions are:

- Remote reclosing of iC60 circuit breakers
- Remote inhibition of the automatic recloser
- Remote control of the final reclosing attempt
- Local control via the handle
- Padlocking to secure the circuit
- 4 operating programs

Identification/Catalog Numbers

The catalog numbers of the ARA automatic reclosers for iC60 circuit breakers are as follows:

iC60 circuit breaker type	ARA iC60 automatic recloser	
	Number of programs	Catalog number
1P, 1P+N, 2P	4	A9C70132
3P, 4P	4	A9C70134

The composition rule for catalog numbers A9C7013• for iC60 circuit breakers is as follows:

Field	A9	C	701	3	• = 2 or 4
Meaning	Acti 9 range	Control	ARA for iC60 circuit breakers iC60	Number of programs: 3 = 4 programs	Number of circuit breaker poles: 2 = 1 or 2 poles 4 = 3 or 4 poles

Example: Catalog number A9C70134 corresponds to an ARA automatic recloser with 4 programs for iC60 4-pole circuit breakers.

Description of Optional Auxiliaries

The unit comprising the ARA automatic recloser and iC60 circuit breaker can be combined with:

- Tripping auxiliaries
- Indication auxiliaries

Circuit breaker tripping auxiliaries allow the circuit breaker to be electrically tripped externally.

Product designation	Catalog number	Description
iMX	A9A26476 A9A26977 A9A26978	Shunt release
iMX+OF	A9A26946 A9A26947 A9A26948	Shunt release with voltage presence check
iMN	A9A26959 A9A26960 A9A26961	Undervoltage release
iMNs	A9A26963	Undervoltage release for a period exceeding 200 ms
iMNx	A9A26969 A9A26971	Undervoltage release independent of the power supply voltage
iMSU	A9A26500	Voltage set point release

Circuit breaker indication auxiliaries indicate the state of the circuit breaker.

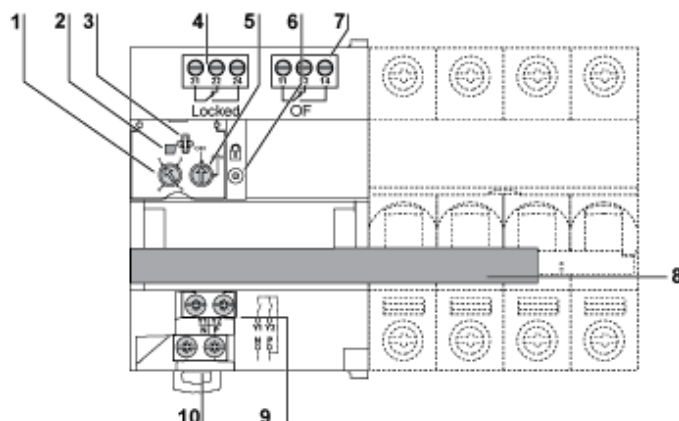
Product designation	Catalog number	Description
iOF	A9A26924 A9A26869	Circuit breaker open/closed indication contact
iSD	A9A26927 A9A26855	Circuit breaker trip state indication contact
iOF/SD+OF	A9A26929	Circuit breaker open/closed and circuit breaker trip state indication contact
iOF+SD24	A9A26897	Circuit breaker open/closed and circuit breaker trip state 24 V DC indication contact

The iMDU adapter auxiliary allows the ARA automatic recloser to be used with differing control voltages.

Product designation	Catalog number	Description
iMDU	A9C18185	24 or 48 V AC/DC – 230 V AC adapter module

Description

Automatic Reclosers for iC60 Circuit Breakers (4 Programs) with 4P Circuit Breaker



- 1 Selector switch for operating program 1 to 4
- 2 Operating state LED
- 3 Sealable cover
- 4 Automatic recloser state terminal block
- 5 Automatic recloser inhibitor switch
- 6 Padlocking device (ARA automatic recloser padlocking)
- 7 Circuit breaker state terminal block (open or closed)
- 8 Opening/closing handle for ARA automatic recloser
- 9 Y1/Y2 control input terminal block
- 10 230 V AC power supply terminal block

No.	Switch	Position	Description
1	Reclosing program selector switch		Automatic recloser set to program 1
			Automatic recloser set to program 2
			Automatic recloser set to program 3
			Automatic recloser set to program 4
5	Automatic recloser inhibitor switch		Automatic recloser inhibited
			Automatic recloser operational

Description of LEDs

Name	State	Description
Automatic recloser state LED		Automatic recloser operational
		Reclosing cycle in progress
		Automatic recloser locked at end of reclosing cycle: circuit breaker tripped (open)
		ARA automatic recloser not operational

Technical Characteristics

General Characteristics

Characteristics		Value
Degree of protection (IEC 60529)	Device alone	IP20
	Device in a modular enclosure	IP40 (insulation class II)
Degree of protection (IEC 62262:2002)		IK05
Degree of pollution (IEC 60947)		3
Rail mounting		DIN 35 mm
Installation position		Any
Supply voltage U _e		230 V AC, 50–60 Hz
Insulation voltage U _i		phase-neutral: 250 V
Rated impulse withstand voltage U _{imp}		<ul style="list-style-type: none"> 4 kV (OVC III class 1) 6 kV (OVC III class 2) on the front panel
Operating temperature		-25° C to +60° C
Storage temperature		-40° C to +85° C
Tropicalization		Execution 2 (93% relative humidity at +40° C)
Weight		440 g
Mechanical durability (NC/NO)		5000 cycles
Resistance to voltage dips		IEC 61 000-4-11 class III
Immunity to power supply frequency variation		IEC 61 000-4-28 and IACS E10
Harmonic resistance		IEC 61 000-4-13 class 2
Immunity to electrostatic discharge	air	8 kV, IEC 61 000-4-2
	contacts	4 kV, IEC 61 000-4-2
Immunity to radiated magnetic fields		12 V/m up to 3 GHz, IEC 61 000-4-3
Immunity to fast transients		4 kV from 5 to 100 kHz, IEC 61 000-4-4
Surge immunity		IEC 61 000-4-5
Immunity to conducted magnetic fields		10 V from 150 kHz to 80 MHz, IEC 61 000-4-6
Immunity to magnetic fields at line frequency		level 4 30 A/m according to IEC 61 000-4-8 and IEC 61 000-4-9
Fire resistance (glow wire)	for live parts	at 960° C 30 s/30 s according to IEC 60 695-2-10 and IEC 60 695-2-11
	for other parts	at 650° C 30 s/30 s according to IEC 60 695-2-10 and IEC 60 695-2-11
	for handle	at 750° C 30 s/30 s according to IEC 60 695-2-10 and IEC 60 695-2-11
Conducted emissions		CISPR 11/22
Radiated emissions		CISPR 11/22
Resistance to corrosive atmospheres (4-gas test)		IEC 60721-3-3 category 3C2
Salt mist		Severity 2 according to IEC 60068-2-52
Environment		Conforms to RoHS directives, halogen free

Control Circuit

Characteristics		Value
Control voltage U_c of inputs Y1, Y2		230 V AC (according to IEC 61131)
Duration of command pulse for input Y2	Minimum	200 ms
	Maximum	—
Maximum response time of input Y2		500 ms
Consumption		≤ 1 W
Inrush consumption		1000 VA for 1P-2P ARA iC60 1400 VA for 3P-4P ARA iC60
Length of control wires for inputs Y1 and Y2 under 230 V AC		<ul style="list-style-type: none"> ● cable: 100 m ● wires in a cable sheath: 500 m

Remote Indication/Control

Characteristics		Value
Consumption of OF changeover contact output	Minimum	10 mA (24 V AC/DC)
	Maximum	1 A (230 V AC)
Consumption of inputs Y1/Y2		230 V AC type 1 according to IEC 61131-2

NOTE: The **OF** and **Locked** contacts may change state for less than 10 ms. These brief changes of state (bounce) must not be taken into account and must be filtered by a device external to ARA.

What Is in This Chapter?

This chapter contains the following topics:

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Assembly

Introduction

The ARA iC60 automatic recloser is used in conjunction with an iC60 circuit breaker.

It is possible to add optional auxiliaries to the iC60 + ARA unit.

Rules for Combination

The table below shows the rules for combining ARA automatic reclosers with iC60 circuit breakers, based on the number of poles on each unit.

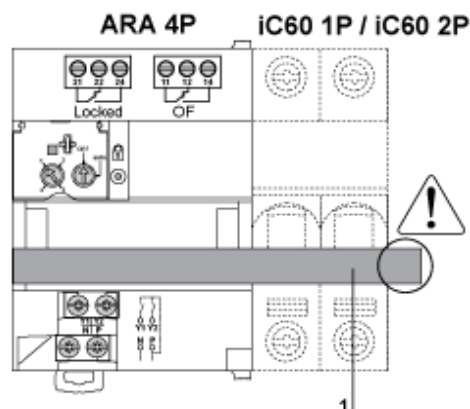
	iC60 1P	iC60 2P	iC60 3P	iC60 4P
ARA iC60 2P	✓	✓	–	–
ARA iC60 4P	–	–	✓	✓

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Do not use an ARA 4P automatic recloser with iC60 1P or 2P circuit breakers. The second circuit breaker connected is at risk of being pulled away by the ARA automatic recloser handle.

Failure to follow these instructions will result in death or serious injury.



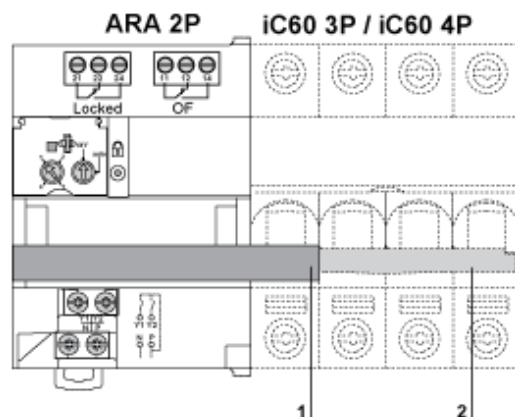
- 1 Opening/closing handle for ARA automatic recloser

NOTICE

HAZARD OF IMPROPER OPERATION

Do not use an ARA 2P automatic recloser with iC60 3P or 4P circuit breakers.

Failure to follow these instructions can result in equipment damage.



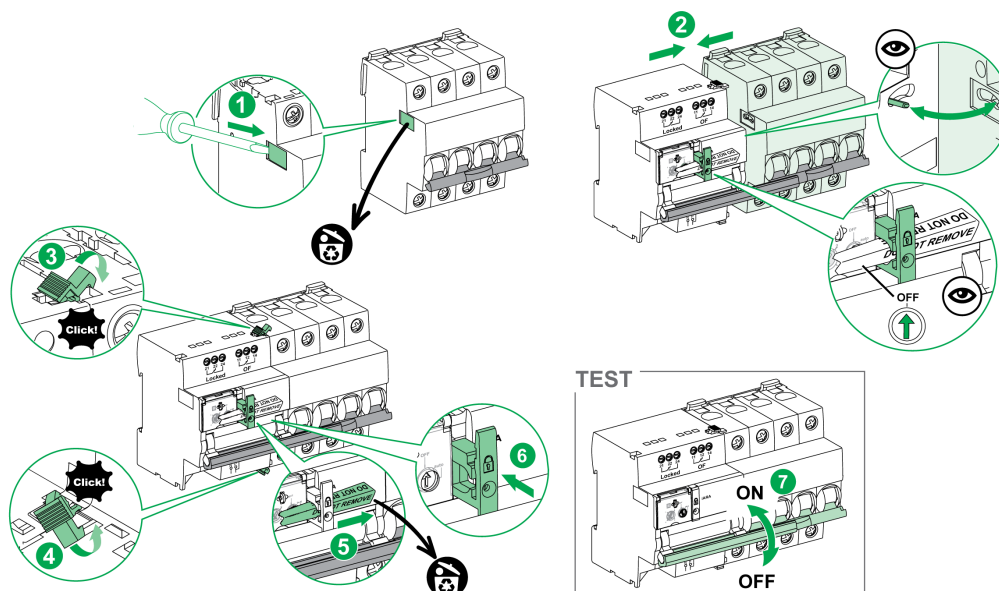
- 1 Opening/closing handle for ARA automatic recloser
2 Opening/closing handle for iC60 circuit breaker

Assembly Procedure with the iC60 Circuit Breaker

Requirements:

- Move the ARA automatic recloser handle to the open position (OFF).
- Move the iC60 circuit breaker handle to the open position (OFF).
- Check that the padlocking device on the ARA automatic recloser is open (device pulled out).

Step	Action
1	Remove the blanking plate on the left-hand side of the iC60 circuit breaker using a screwdriver.
2	<ul style="list-style-type: none"> • Set the remote control inhibitor switch to OFF to unlock the padlocking device. • Connect the ARA automatic recloser to the iC60 circuit breaker, ensuring that the release rod is inserted correctly.
3	Close the locking tab located on top of the ARA automatic recloser.
4	Close the locking tab located underneath the ARA automatic recloser.
5	On a new product remove the piece of card holding the padlocking device in the open position.
6	Push back the padlocking device.
7	Check that the unit has been assembled correctly by moving the handle from the ON to the OFF position and back again.



Assembly with Optional Auxiliaries

Once the ARA iC60 automatic recloser has been assembled with an iC60 circuit breaker, the following auxiliaries can be added:

- one Vigi iC60 auxiliary
- a maximum of 2 indication/tripping auxiliaries

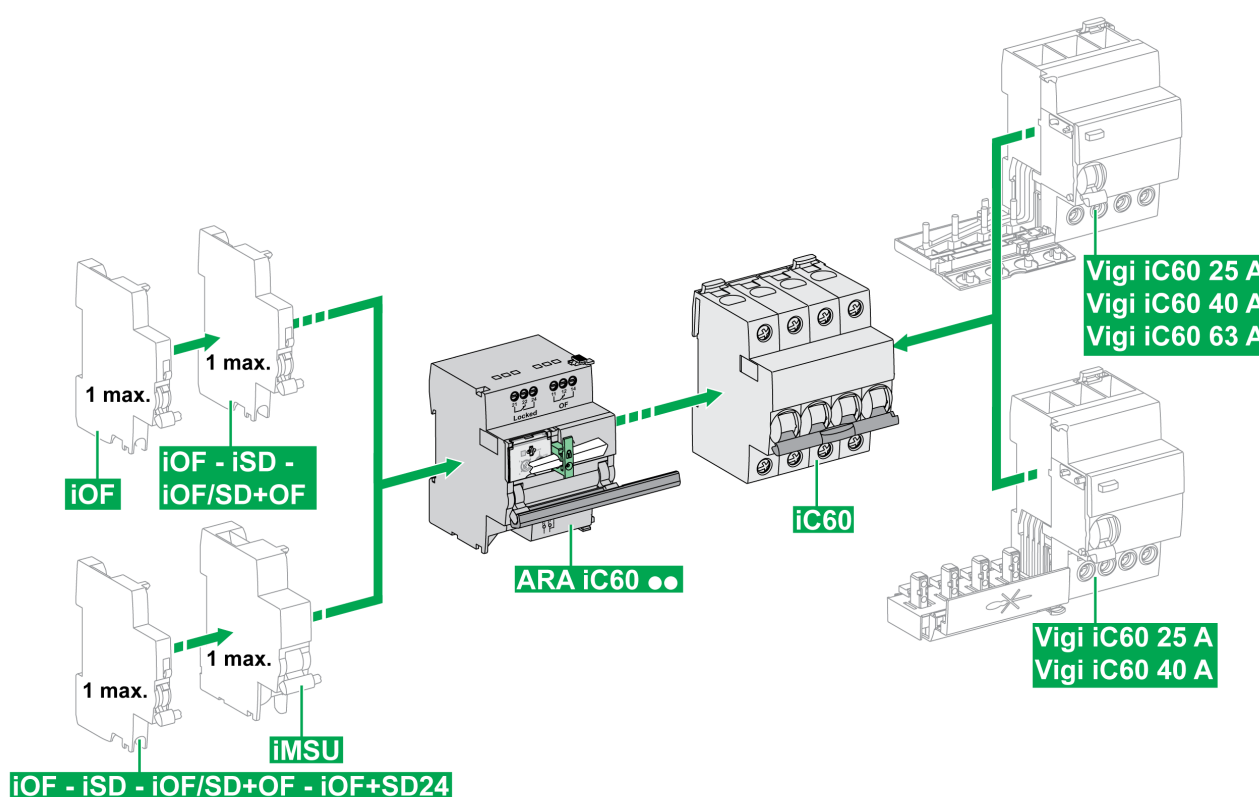
The following table shows the possible combinations of indication or tripping auxiliaries in position 2 depending on the auxiliary in position 1. The auxiliary in position 1 is located closest to the automatic recloser.

Position	1°	iOF	iSD	iOF/SD+OF	iOF+SD24	iMX	iMX+OF	iMN	iMNs	iMNx	iMSU
2°											
iOF		√	√	√	—	√	√	√	√	√	√
iSD		—	—	—	—	√	√	√	√	√	√
iOF/SD+OF		—	—	—	—	√	√	√	√	√	√
iOF+SD24		—	—	—	—	√	√	√	√	√	√
iMX		—	—	—	—	—	—	—	—	—	—
iMX+OF		—	—	—	—	—	—	—	—	—	—
iMN		—	—	—	—	—	—	—	—	—	—
iMNs		—	—	—	—	—	—	—	—	—	—
iMNx		—	—	—	—	—	—	—	—	—	—
iMSU		—	—	—	—	—	—	—	—	—	—

The auxiliaries:

- must be mounted to the left of the ARA automatic recloser
- must not be mounted between the ARA automatic recloser and the iC60 circuit breaker

The diagram below shows the possible combinations of an ARA iC60 automatic recloser assembled with an iC60 circuit breaker and optional auxiliaries.



Assembly Procedure with Auxiliaries

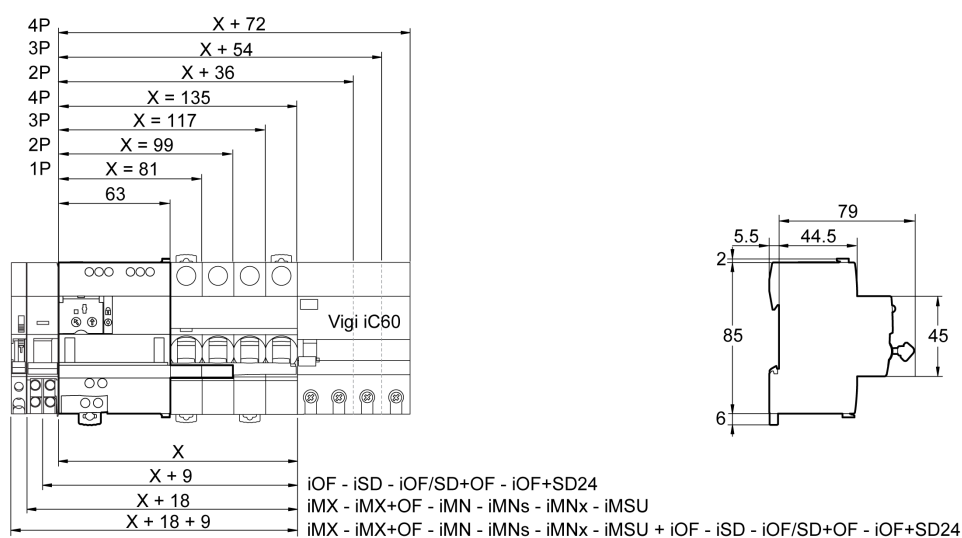
Requirements:

- Move the ARA automatic recloser handle to the open position (OFF).
- Move the iC60 circuit breaker handle to the open position (OFF).
- Check that the padlocking device on the ARA automatic recloser is open (device pulled out).

Step	Action
1	Remove the blanking plate on the left-hand side of the ARA automatic recloser using a screwdriver.
2	<ul style="list-style-type: none"> • Set the remote control inhibitor switch to OFF to unlock the padlocking device. • Assemble the ARA automatic recloser with the auxiliary.
3	On a new product remove the piece of card holding the padlocking device in the open position.
4	Push back the padlocking device.
5	Check that the unit has been assembled correctly by moving the handle from the ON to the OFF position and back again.
6	Follow the same procedure to add an additional auxiliary.

Dimensions

The dimensions of the ARA iC60 automatic recloser assembled with an iC60 circuit breaker and, optionally, with a Vigi iC60 and an indication/tripping auxiliary are as follows:



The widths of the indication/tripping auxiliaries are as follows:

Auxiliary	Type	Width
Indication	iOF - iSD - iOF/SD+OF - iOF+SD24	9 mm
Tripping	iMX - iMX+OF - iMN - iMNs - iMNx - iMSU	18 mm
Indication + tripping	iOF - iSD - iOF/SD+OF - iOF+SD24 + iMX - iMX+OF - iMN - iMNs - iMNx - iMSU	27 mm

Connection

Safety Instructions

⚡ ⚠ DANGER

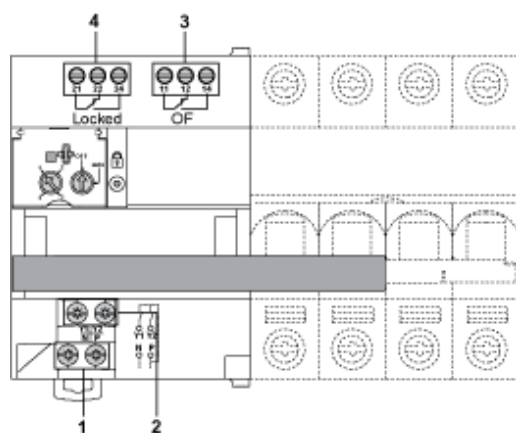
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Wear appropriate personal protective equipment and follow the standard electrical safety precautions.
- Only qualified electricians who have read the relevant instructions are authorized to install this equipment.
- NEVER work alone.
- Disconnect all current and voltage sources before carrying out visual inspections, testing or maintenance work on this equipment. Always assume that all circuits are live until they have been de-energized, tested and labeled. Pay particular attention to the design of the power supply circuit. Take account of all power supply sources, including in particular feedback possibilities.
- Before closing the covers and doors, carefully inspect the working area to ensure that no tools or other items have been left inside the equipment.
- Take care when removing or replacing panels. In particular, make sure that they do not touch live busbars. To minimize the risk of injury, avoid handling panels.
- If this equipment is to remain in good working order it must be handled, installed and operated correctly. Failure to comply with basic installation instructions may lead to injury and may damage the electrical equipment or other property.
- NEVER shunt an external fuse/circuit breaker.
- This equipment must be installed inside a suitable electrical cabinet.

Failure to follow these instructions will result in death or serious injury.

Connection Blocks

The figure below shows the 4 connection blocks for an ARA automatic recloser.



- 1 230 V AC power supply terminal block
- 2 Y1/Y2 control input terminal block
- 3 Circuit breaker state indication contact terminal block (OF)
- 4 Automatic recloser state terminal block

Description of Terminals

1, 230 V AC power supply terminal block

Terminals	Function
N	Neutral
P	Phase

2, Y1/Y2 control input terminal block

Terminals	Function
Y1	Remote inhibition of automatic recloser
Y2	Remote control of final reclosing attempt

3, circuit breaker state indication contact terminal block (OF)

Terminals	Contact	Function
11-12	NC (normally closed)	Circuit breaker state: closed
11-14	NO (normally open)	Circuit breaker state: open

4, automatic recloser state terminal block

Terminals	Contact	Function
21-22	NC (normally closed)	Automatic recloser state: locked
21-24	NO (normally open)	Automatic recloser state: not locked

Connection Characteristics

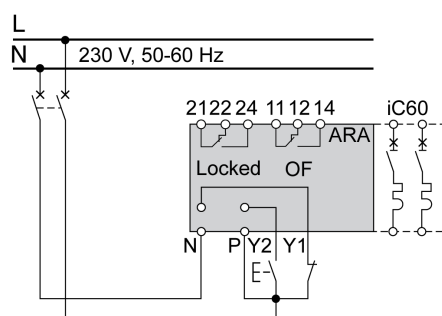
No.	Terminal block	Tightening torque	Stripping length	Wire size			
				Solid	Flexible	Flexible with ferrule	2 cables
1	Power supply (230 V AC)	1 N.m	10 mm	0.5...10 mm²	0.5...6 mm²	0.5 to 4 mm²	0.5 to 2.5 mm²
2	Inputs Y1/Y2						
3	NC/NO output	0.7 N.m	8 mm	0.5 to 2.5 mm²		0.5 to 1.5 mm²	0.5 to 1.5 mm²

Connection Scheme

NOTICE

RISK OF MALFUNCTION

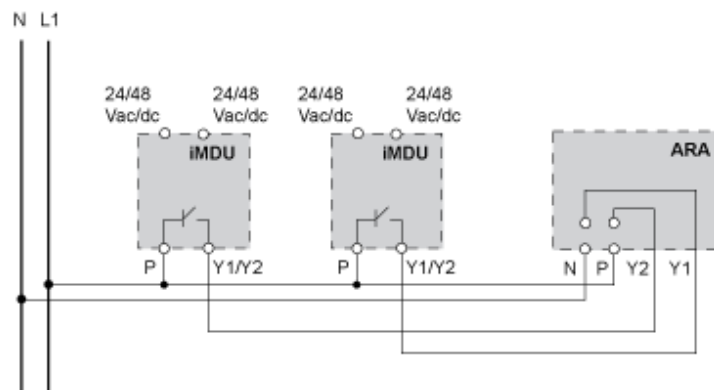
In three-phase applications, use the same phase to connect the power supply and inputs Y1 and Y2.
Failure to follow these instructions can result in equipment damage.



Power Supply to Control Inputs via an iMDU Auxiliary

The Y1/Y2 control inputs of ARA automatic reclosers operate with a voltage of 230 V AC. An iMDU auxiliary allows an ARA automatic recloser to be controlled by means of a 24/48 V AC/DC output.

The diagram below shows the connection of the control inputs of the ARA automatic recloser by means of iMDU auxiliaries.



The catalog number for the iMDU auxiliary can be found in the corresponding section (*see page 10*).

Usage

3

What Is in This Chapter?

This chapter contains the following topics:

Topic	Page
Operation	24
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Operation

Introduction

The ARA automatic recloser performs a certain number of reclosing operations depending on the program selected by the user.

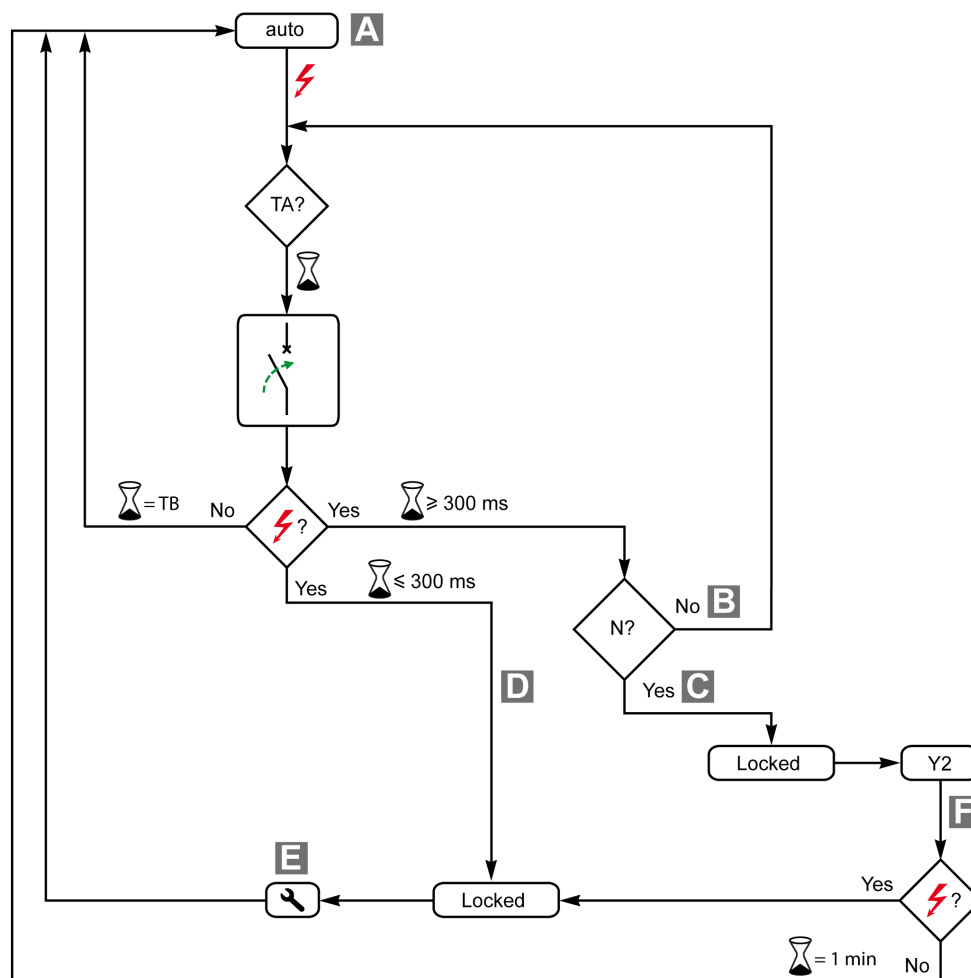
The program includes the following settings:

- A time delay before reclosing (TA)
- A check time (TB)
- A maximum number of reclosing attempts (N)

If the fault is still present after these reclosing attempts, the device locks itself out. When the device is locked, the circuit breaker can only be reclosed either manually or by means of a final closing attempt via the Y2 input.

Operating Principle of the Automatic Recloser

When a fault occurs, the system trips and reclosing takes place at the end of time TA. After reclosing, if a new fault occurs during time TB, the fault counter is incremented or else the counter is reset to 0. If the fault counter exceeds the maximum authorized number of reclosing operations, reclosing is locked. The automatic recloser then has to be reinitialized either manually or remotely by means of input Y2.



Key	Description
TA	Time delay before reset
	Reclosing
TB	Check time after reset
	Fault
N	Permitted number of reclosing cycles
Y2	Final reclosing attempt
	Locked state: intervention needed

Each response by the ARA automatic recloser is detailed in a timing diagram:

Timing diagram	Description
A	Activation and inhibition of the automatic recloser (see page 27)
B	Transient faults ($n \leq N$) (see page 27)
C	Transient faults ($n > N$) (see page 28)
D	Permanent fault (see page 28)
E	Reinitialization of the automatic recloser (see page 29)
F	Final reclosing attempt (see page 29)

Type of Fault

2 types of fault can occur on a line:





- Transient: The fault occurs but does not reappear
- Permanent: The fault is continuously present

The automatic recloser provides a means of dealing with these various fault types.

Reclosing Programs

The reclosing program is selected by means of a 4-position switch located on the front panel.

The available reclosing programs are shown in the following table:

Program	Program type	Number of reclosing operations	Time delay before reclosing TA	Check time TB	Final reclosing attempt Y2
	Short cycle	1	60 s	6 min	Once after inhibition
		3	60 s 3 min 3 min	2 min 6 min 6 min	
	Long fixed cycle	5	60 s 3 min 3 min 3 min 3 min	2 min 6 min 6 min 6 min 6 min	
	Long progressive cycle	5	60 s 3 min 4 min 5 min 6 min	2 min 6 min 8 min 10 min 12 min	

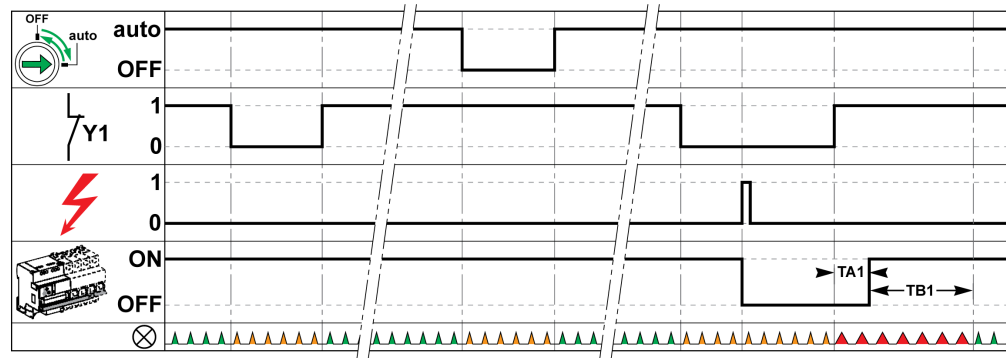
Timing Diagram A: Activation and Inhibition

The automatic recloser can be activated or inhibited in 2 ways:

- Remotely, by means of input Y1
- Locally, by moving the OFF/auto switch to the OFF position.

When the automatic recloser is inhibited, the state LED flashes orange and reclosing is impossible.

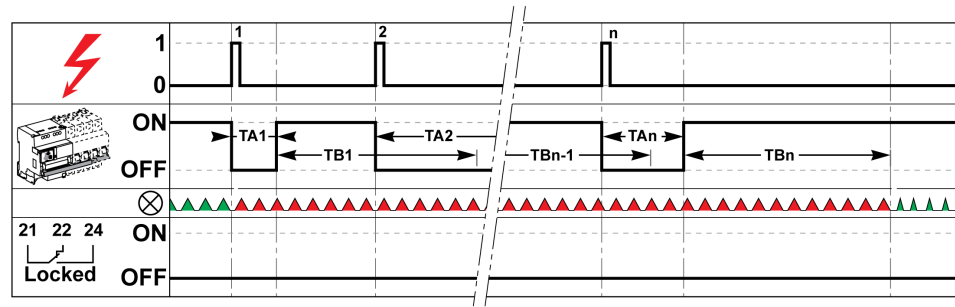
The following timing diagram illustrates operation of the ARA iC60 automatic recloser for all programs:



Timing Diagram B: Transient Faults ($n \leq N$)

Several short-lived faults occur in succession: the fault counter is incremented consecutively but the maximum authorized number of reclosing operations is not reached. The automatic recloser protects the installation while also maintaining its availability.

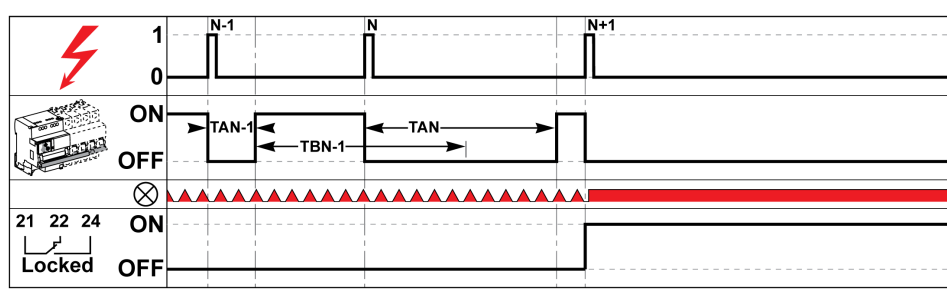
The following timing diagram illustrates operation of the ARA iC60 automatic recloser for all programs:



Timing Diagram C: Transient Faults ($n > N$)

Several short-lived faults occur on the line and their number exceeds the maximum authorized number of faults to ensure the safety of the installation. The automatic recloser locks and the installation is not powered up again: the automatic recloser maintains the safety of the installation.

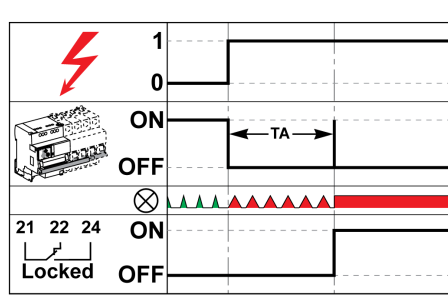
The following timing diagram illustrates operation of the ARA iC60 automatic recloser for all programs:



Timing Diagram D: Permanent Fault

If a permanent fault occurs on the installation, the automatic recloser locks after the maximum authorized number of reclosing operations has been reached. The installation cannot be powered up again automatically. Human intervention is needed to clear the fault. The safety of the installation is maintained.

The following timing diagram illustrates the operation of the ARA iC60 automatic recloser with programs 1 and 2:

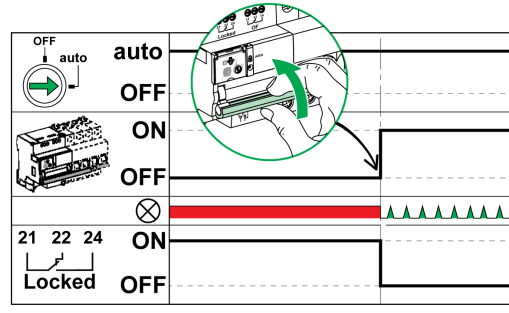


Timing Diagram E: Reinitialization

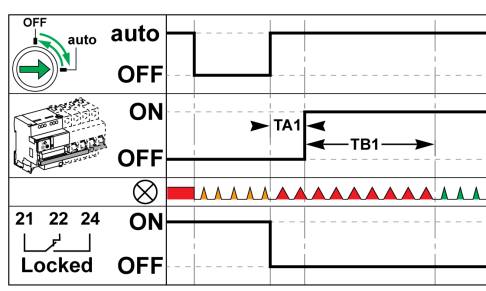
If the automatic recloser is locked (owing to too high a number of reclosing attempts), it can be reinitialized in 2 ways:

- By reclosing the circuit breaker manually using the handle. In this case reclosing is immediate.
- By moving the auto/OFF switch to the OFF position and then to the auto position. In this case reclosing occurs at the end of time TA.

The following timing diagram illustrates operation of the ARA automatic recloser when the circuit breaker is reinitialized by manual reclosing:



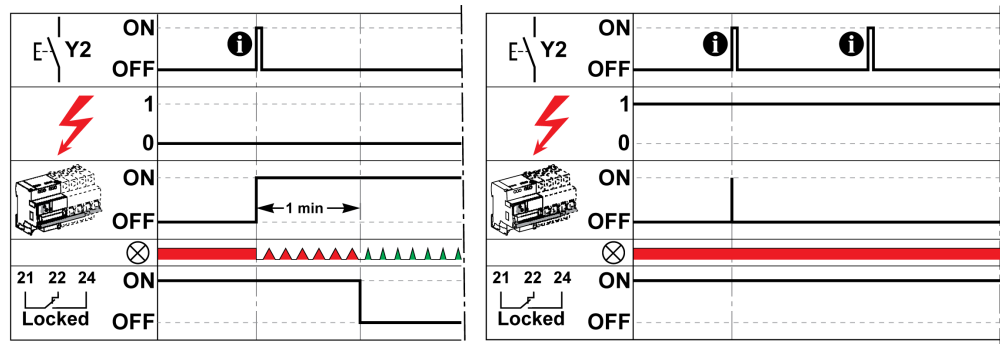
The following timing diagram illustrates operation of the ARA automatic recloser when the circuit breaker is reinitialized by means of the auto/OFF switch:



Timing Diagram F: Final Reclosing Attempt

If the automatic recloser is locked, a pulse at input Y2 can be used to reclose it remotely. Only one reclosing attempt is permissible.

The following timing diagram illustrates operation of the ARA iC60 automatic recloser for all programs:

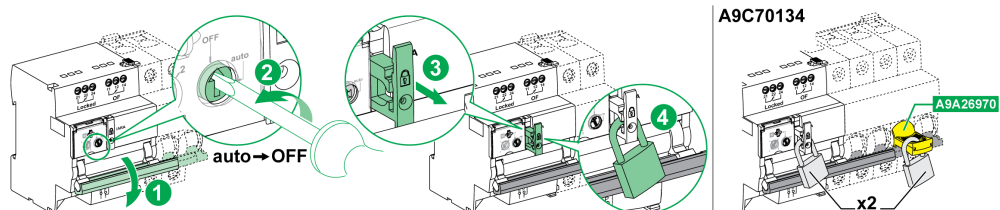


i: Only one Y2 command can be attempted in order to reclose the locked ARA iC60 automatic recloser.

Usage

Padlocking

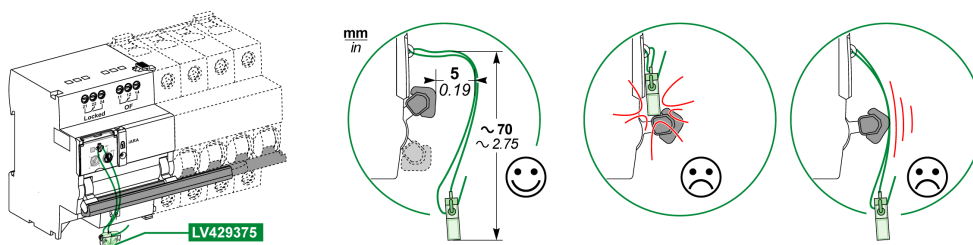
This procedure shows how to padlock the ARA automatic recloser and the circuit breaker before starting electrical work. It is impossible to reclose the automatic recloser and circuit breaker either remotely or locally without removing the padlock and pushing in the padlocking device.



Step	Action
1	Open the circuit breaker by moving the handle down.
2	Set the remote control inhibitor switch to the OFF position.
3	Pull out the padlocking device of the ARA automatic recloser.
4	Attach the padlock (diameter 3 to 6 mm) to the padlocking device.
5	On 3P/4P circuit breaker modules attach a second padlock to the circuit breaker using the A9A26970 accessory.
6	The automatic recloser and the circuit breaker are electrically padlocked.

Sealing the Front Panel

The ARA automatic recloser has a sealable cover to prevent access to the operating mode settings. The LV429375 sealing kit should be used. As illustrated in the figure below, the sealing wire should be shaped to ensure it remains outside the range of movement of the handle.



Application Example for ARA Automatic Recloser

Introduction

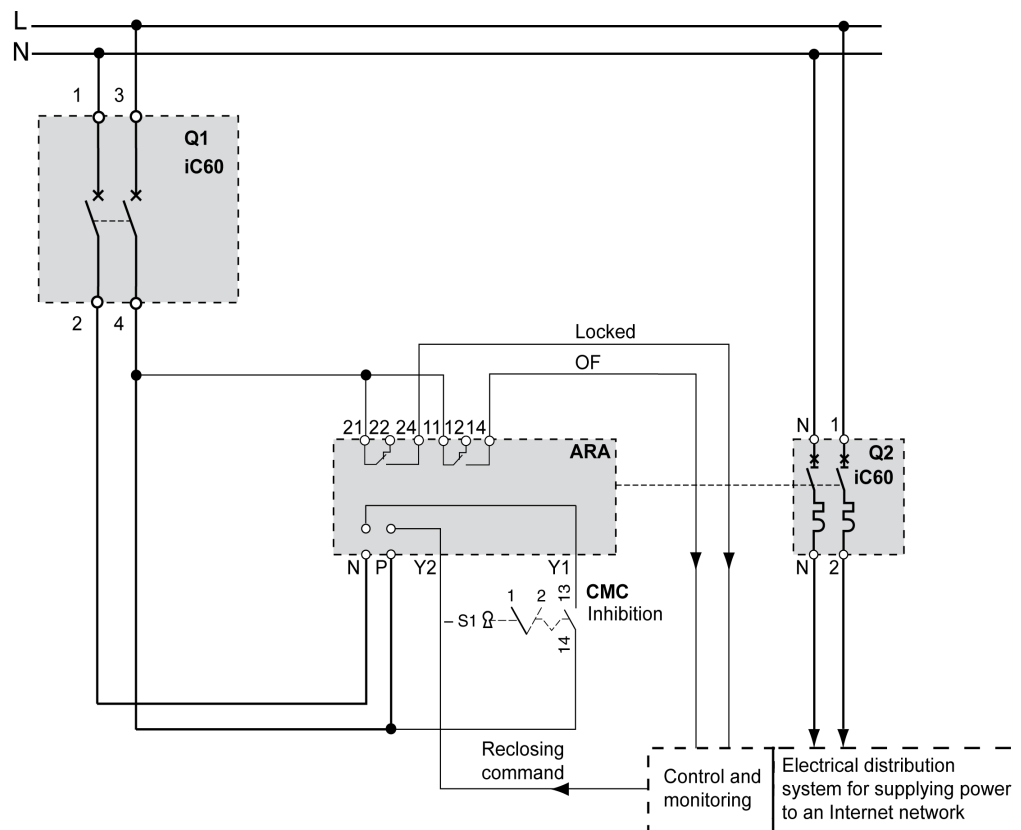
The ARA automatic recloser can be used to carry out the following operations:

- Automatically reclose an iC60 circuit breaker
- Select a predefined reclosing program to ensure the safety and availability of installations, depending on the type of installation
- Padlock the automatic recloser

The ARA automatic recloser increases the availability of installations which are unmonitored, isolated, difficult to access or demand high availability (mobile telephony systems, roads, pumping stations, airports, railways, meteorological stations, service stations, automated teller machines, public lighting, tunnels, etc.). In the case of transient faults (atmospheric disturbance, industrial overvoltages, etc.), availability can be maintained without the need for operator intervention.

Application Example of the Power Supply to an Internet Distribution Box

The diagram below shows the use of an ARA automatic recloser with an iC60 circuit breaker to control an electrical distribution system for supplying power to an Internet network.





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As standards, specifications and designs change from time to time, please ask for confirmation of the information given in this publication.

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